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March 14, 1996

By Hand

Michele Farquhar
Chief, Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, NW, Room 5002
Washington, DC 20554

Scott Blake Harris
Chief, International Bureau
Federal Communications Commission
2000 M Street, NW, Room 800
Washington, DC 20554

Re: 28 GHz Band Segmentation Plans
CC Docket No. 92-297

Dear Ms. Farquhar and Mr. Harris:

As a follow-up to our letters to you dated March 4 and March 6, 1996, highlighting numerous grossly inaccurate and misleading assertions of Hughes Communications Galaxy, Inc. ("Hughes") about the impact to LMDS systems of the "Option 5" band segmentation plan, CellularVision USA, Inc. ("CellularVision") is writing to provide further evidence in the record to confirm why the Commission's adoption of Option 5 in the 28 GHz Rulemaking would cause such significant technical design, equipment manufacturing and financial problems for the deployment of LMDS as to effectively destroy its applicability as a competitive nationwide two-way video, telephony and data wireless broadband technology in the United States.

In this regard, CellularVision, the parent of the only commercial Local Multipoint Distribution Service ("LMDS") licensee in the United States, and the tentative awardee of a pioneer's preference for its leadership role in developing LMDS, has asked the suppliers of equipment for its commercially operational system in the New York PMSA to consider the resulting design changes and impact on manufacturing that could be reliably expected to occur in the mass production of equipment supporting two-way LMDS video, telephony and data services if Option 5 were adopted by the Commission. As explained in greater detail in the enclosed letters from M/A-COM, Inc. ("M/A-COM"), Titan Information Systems, Inc. ("Titan") and mm-Tech, Inc. ("mm-Tech"), LMDS equipment can be readily manufactured with manageable increased costs to conform to

the LMDS 850 MHz and 135 MHz allocations under Option 4.

By contrast, these independent vendors conclude that the fragmented 700/150/150 MHz LMDS allocation proposed under Option 5 would require such fundamental, complex and burdensome system design changes as to render the upper 150 MHz (from 29.1-29.25 GHz) useless for LMDS deployment, and by doing so, threaten the viability of LMDS in the United States. The Commission should take note of the fact that these three respected equipment manufacturers, two of whom have been leaders in the U.S. defense industry, have invested vast millions of R&D dollars in support of their efforts to meet the equipment needs of a U.S. and global LMDS market on the verge of explosive growth. Separately, M/A-COM, Titan and mm-Tech all have been unable to detail the costs of the complex redesign requirements that would be triggered by Option 5, since much of the technology to overcome the significant LMDS system design problems posed by Option 5 has yet to be developed and in some cases, may be impossible to develop. As a result, these equipment manufacturers have independently concluded that the system and equipment redesign necessitated by Option 5 would be of a magnitude to make LMDS in the United States unsuitable for commercial deployment. Clearly, under those circumstances, LMDS would no longer be viewed as an attractive vehicle for reducing the federal deficit through auctions of the 1 GHz of 28 GHz spectrum allocated to LMDS.

- For example, M/A-COM, which manufactures the antenna downconverter assembly used by CellularVision in its commercial LMDS system, points to several specific problems caused by the Option 5 band plan. First, in a two-way LMDS system, the receive filters at a subscriber station would have to be very complex in order to prevent subscriber transmissions in the 28.45-28.6 GHz band from interfering into the reception of the 27.5-28.2 GHz and 29.1-29.25 GHz bands. As M/A-COM states, "the receive filters of the Transmit/Receive duplexer will be rather complicated; it will consist of a dual-band receive filter, in fact a dual band multiplexer, and a transmit filter whose pass band is sandwiched between the two receive bands."[1]

- Moreover, M/A-COM adds that the dissipative loss in waveguide filters could cause the 29.1-29.25 GHz band to have a greatly diminished service area, stating that "the dissipative loss caused by a fundamental mode waveguide filter may erode the rain margin to the extent of rendering the upper 150 MHz band useless for all but a small fraction of the cell near the hub."[2]

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[1] See Letter from Robert Egri, M/A-COM, to Shant Hovnanian, March 13, 1996, p.2 (copy enclosed).

[2] Id.

- In addition, under an Option 5 configuration, M/A-COM explains that LMDS would lose the benefits of widely available multichannel video subscriber receivers and LMDS set-top receivers would have to undergo expensive redesign using two millimeter-wave local oscillators.[3]

- mm-Tech, which manufactures the transmitters used by CellularVision in its New York system, explains that from its perspective "the most striking problem" with Option 5 is the need to use the 700 MHz at 27.5-28.35 GHz along with the 150 MHz from 29.1-29.25 GHz for hub to subscriber transmissions. Based on the 1.75 GHz span of spectrum between these two bands, mm-Tech explains that an LMDS operator would have to choose between using a single block conversion transmitter and transmitter antenna system, which would likely result in a significant reduction in cell size, or a dual transmitter/antenna scheme – in either case drastically increasing hub transmitter equipment costs.[4]

- Titan, which is the supplier of the set-top decoders used by CellularVision, states that "[t]he uncertainties associated with the band segmentation plan dictated by Option 5, if it is adopted, would so severely impair the level and quality of the services that could be offered by an LMDS operator that it is doubtful that LMDS as currently envisioned would survive."[5]

The record in this proceeding contains substantial evidence provided by CellularVision and numerous other parties that unequivocally demonstrates the severe penalty that adoption of Option 5 would force upon the nationwide deployment of LMDS in the U.S. Moreover, Hughes' disingenuous and flawed analysis purporting to support the viability of LMDS under Option 5 has been thoroughly discredited in the record and simply does not provide a basis for the adoption of Option 5.[6] Like the satellite

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[3] Id.

[4] See Letter from Charles S. Brand, President, mm-Tech, to Shant Hovnanian, March 12, 1996 (copy enclosed).

[5] See Letter from Charles F. Newby, Vice President, Titan, to Shant Hovnanian, March 13, 1996, p.2 (copy enclosed).

[6] See Letters from Counsel for CellularVision to Michele Farquhar and Scott Blake Harris, CC Docket No. 92-297, March 4, 1996, and March 6, 1996; Letter from Donald C. Brittingham, Bell Atlantic, Robert H. Jackson, US West and Ralph Ballart, Telesis Technologies Laboratory, to Michele Farquhar and Scott Blake Harris, CC Docket No. 92-297, March 8, 1996; Letter from Gene Robinson, Texas Instruments, Doug Lockie, Endgate Technologies and Samir Kamal, Hewlett-

industry's now-discredited delaying campaign to move LMDS to 40 GHz that consumed significant resources from the embryonic LMDS community to debunk, Option 5 has surfaced at the 11th hour as another transparent red herring designed by the satellite interests to prolong the 28 GHz Rulemaking and further limit LMDS entry into the highly competitive communications marketplace ushered in by the enactment of the Telecommunications Reform Act of 1996 ("Telecom Act").

Ironically, while the 104th Congress has achieved a legislative tour de force by its passage of this multi-faceted and comprehensive deregulatory Telecom Act, the U.S. satellite industry, led by Hughes, whose DBS system is a direct competitor of LMDS, has succeeded in wasting several years of the Commission's resources by delaying the nationwide licensing of LMDS in the valuable yet still largely fallow 28 GHz spectrum – spectrum that LMDS proponents and Wall Street investors are prepared to pay for at auctions, while yet-to-be technically proven and financed satellite systems such as Hughes Spaceway are able to hoard massive portions of the 28 GHz band, as well as the companion 19 GHz downlink band, free of charge.

Importantly, while the Commission allows the satellite interests to continue to delay the outcome of this proceeding, other countries, such as Canada, no longer are waiting for the Commission to take the lead and are moving forward with spectrum allocations for LMDS-type services that are far more favorable to LMDS than the band plan Options being considered by the Commission.[7] In fact, Canada has dedicated 3 GHz of contiguous spectrum, from 25.35-28.35 GHz for LMDS service, and will immediately license nationwide 1 GHz from 27.35-28.35 GHz, with applications due by April 1, 1996.[8] By contrast, the FCC commenced this proceeding in 1992 by proposing

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Packard to William F. Caton, CC Docket No. 92-297, March 6, 1996; Letter from Patrick J. Greaney, Senior Vice President, Philips Electronics, to Michele Farquhar and Scott Blake Harris, CC Docket No. 92-297, March 8, 1996; Letter from Charles F. Newby, Vice President, Titan Information Systems Corporation, to Michele Farquhar and Scott Blake Harris, CC Docket No. 92-297, March 7, 1996; Letter from Steve Copold, Director of Information Resources, The University of Texas - Pan American, to Chairman Hundt and Commissioners, CC Docket No. 92-297, February 29, 1996.

[7] See Letter from CellularVision to Chairman Hundt and Commissioners, CC Docket No. 92-297, March 5, 1996.

[8] Canada's version of LMDS is called Local Multipoint Communications Systems, defined as "wireless broadband distribution systems, operating in a cellular fashion, possibly providing an array of video, data and telephony services directly to residential and business subscribers." Local Multipoint Communications

to allocate the full 2 GHz from 27.5-29.5 GHz for LMDS, which frustrated LMDS proponents have seen continually diminished over a period of several years, now to the current debate between Option 4 Prime's noncontiguous 850/135 MHz LMDS allocation or Option 5's highly fragmented and simply unworkable 700/150/150 MHz proposal.

LMDS, based on a U.S.-pioneered technology, is poised for immediate deployment throughout the United States today through spectrum auctions, and CellularVision urges the Commission to finally and promptly conclude this proceeding with the adoption of a band plan that addresses the well-documented needs of the LMDS community.

Sincerely,

Michael R. Gardner
Charles R. Milkis
Counsel for CellularVision

Enclosures

cc Chairman Reed E. Hundt
Commissioner James H. Quello
Commissioner Andrew C. Barrett
Commissioner Rachelle Chong
Commissioner Susan Ness
Blair Levin
Ruth Milkman
Jackie Chorney
Lauren J. Belvin
Rudolfo M. Baca
Lisa B. Smith
Brian Carter
Jane Mago
Suzanne Toller
Mary P. McManus
David R. Siddall
David Wye
Rosalind Allen
Robert James
Susan Magnotti
Robert M. Pepper
Gregory Rosston
Donald H. Gips
Thomas Tycz
Harry Ng
Karl Kensinger
Jennifer Gilsenan
Michael J. Marcus
William Caton

Systems in the 28 GHz Range, submitted as an attachment to the March 5, 1996 letter from CellularVision to the Chairman and Commissioners, supra note 7.

M/A-COM
100 Chelmsford Street
Lowell, MA, 01853

March 13, 1996

Mr. Shant Hovnanian
Cellular Vision
505 Park Avenue
New York, NY 10022

Dear Mr. Hovnanian:

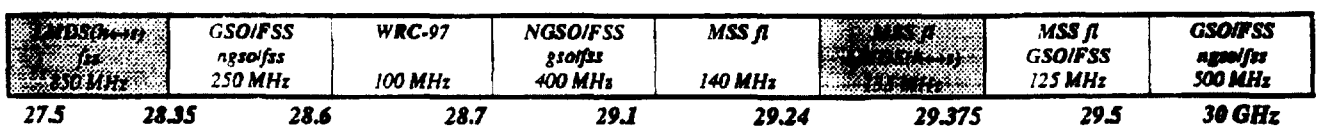
This letter is to answer your questions regarding the feasibility of the proposed Options 4' and 5 frequency allocations. *M/A-COM* being the sole manufacturer of the current one-way *LMDS* antenna down-converter assembly is in a unique position to give informed opinion concerning the effects of such allocation change may have on the cost and manufacturability of the customer premises equipment.

In both Option 4' and Option 5 the separation between the lowest to the highest band edges is larger than 1 GHz, which is the frequency span of the commercial *LMDS* system in New York. Because of this spectral coverage increase the antenna must be redesigned. It is likely that two separate antennas will be required to maintain current performance with the obvious cost impact.

It may be possible to design a single antenna but it will be larger and more expensive than the current one. Additionally - and this is critical - the single antenna will not be able to meet the current performance characteristics. To meet the current gain objective it must be larger and consequently the beam width will be narrower, and this will cause operational pointing problems. If you wish to maintain the current beam width to minimize pointing problems the gain will be degraded causing a decrease in the system's *figure of merit* resulting in smaller cells and higher overall system cost. We will also have transmission ripple and VSWR problems with worse sidelobe performance.

In Option 4' *LMDS* receives 985 MHz of band width of which 850 MHz is allocated continuously from 27.5 to 28.35 GHz. The remaining 135 MHz is shared jointly with satellite interests from 29.24 GHz to 29.375 GHz. The full planned allocation is shown in Figure 1.

Figure 1

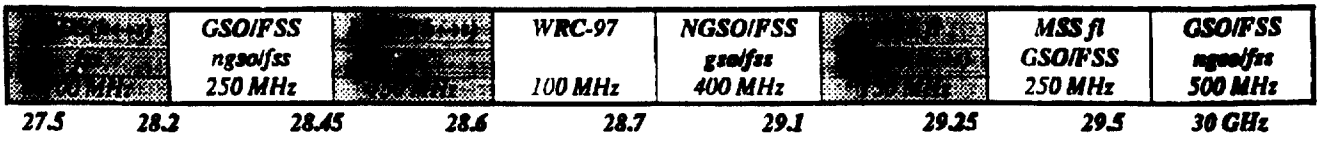


This splitting of the band is natural for a two-way system with asymmetrical channel allocation. The customer premises equipment should contain a Transmit/Receive frequency duplexer following the antenna. In this duplexer the transmit band is located in the upper 135 MHz and the receive band is in the lower 850 MHz. Given the almost 900 MHz separation between the transmit and receive bands it should be reasonably easy to design and manufacture for mass production such duplexer for around 10% of the current one-way receiver cost.

Special concern will be in the duplexer design the sufficient rejection of the neighboring *GSO/FSS* signals to prevent them to cause nonlinear distortion and signal suppression in the low noise front end receiver. To reduce dissipative losses this filter must be made in a waveguide right next to the antenna.

Unfortunately, for Option 5 the situation is quite different. The *LMDS* allocation is split in to *three* non-contiguous segment: one 700 MHz from 27.5 to 28.2 GHz, one 150 MHz segment from 28.45 to 28.6 GHz and a third 150 MHz segment from 29.1 to 29.25 GHz. This third segment may only be used from the hub to the subscriber (see Figure 2).

Figure 2



This is a rather problematic channel allocation. Adjacent to the *LMDS* bands are potentially high power jammer up-links that could desensitize a wide band low noise front end. To prevent nonlinear distortion and signal suppression effects the *LNA* will have to be preceded by a fairly selective receive filter. If the second segment is used for transmission from the subscriber to the hub then the transmit filter of the duplexer must also be fairly selective because of the meager 250 MHz separation between the first an second segments. Since the upper 150 MHz can only be used in a receive mode at a subscriber terminal, the receive filters of the Transmit/Receive duplexer will be rather complicated: it will consist of a dual-band receive filter, in fact a dual band multiplexer, and a transmit filter whose pass band is sandwiched between the two receive bands.

Because of their different relative band widths the two receive bands will have different loss characteristics. With the same construction the narrower filter at the higher end will have approximately 700/150 = 4.7 times higher loss in *dB*s than the wider one at the lower end. Since over-moded waveguide filters may be exceedingly difficult and expensive to tune at *mm-wave* frequencies and will also be sensitive to environmental variations the dissipative loss caused by a fundamental mode waveguide filter may erode the rain margin to the extent of rendering the upper 150 MHz band useless for all but a small fraction of the cell near the hub.

Additional complication is the *more* than 1 GHz separation between the *first* and *third* segments. In the current one-way system the received signal is mixed down to 1 to 2 GHz in a single heterodyne stage. This IF is then demodulated by the set-top receiver. With the proposed frequency allocation in Option 5 one either will have to redesign the set-top box, or modify the heterodyning stages by adding a second IF stage with a synthesized switchable second LO, or have *two mm-wave oscillators* with an electronically controlled selector switch between them. Both switchable oscillator suggestions are doable, but at a rather high incremental cost over that of Option 4' whose frequency allocation does not require dual receiver LO at all.

In summary, the incremental cost of the *mm-wave* and RF portion of the customer premises hardware for a two-way *LMDS* with Option 4' frequency allocation appears to be quite acceptable when contrasted with the current one-way system.

On the other hand, the cost of the Option 5 receiver will be significantly higher than that, even excluding the cost of the duplexer. It is also questionable if the duplexer is mass producible at all, or if manufactured, the system can allow the reduction in link margin caused by the excessive dissipative losses in the filter. In this case the third frequency segment may not be useable in rain or heavy fog.

Because of these reasons I believe that, unlike Option 4', *Option 5 is not viable* for a mass producible two-way *LMDS* customer premises equipment.

Sincerely,

Robert Egri

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New York City NY 10022
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March 13, 1996

Re: CC Docket 92-297
28 GHz Spectrum Plan

Dear Mr. Hovnanian:

This letter is in response to your request that Titan Information Systems Corporation (Titan) assess the impact that current 28 GHz spectrum sharing plans being considered by the FCC would have on current and planned LMDS services.

To reiterate, the adoption of Option 5 would mean that the LMDS band is split into three non-contiguous bands -- this band segmentation plan would put LMDS at a severe market disadvantage relative to other multichannel program providers. There are significant technical and cost implications associated with the design and manufacture of antennas, downconverters, set-top decoders and signal distribution systems, especially in multi-dwelling units, due to the non-contiguous nature of the spectrum plan dictated by Option 5.

Mr. Fitzpatrick, of Hughes Communications Galaxy, Inc., asserts in a March 1 letter to Ms. Farquhar and Mr. Harris of the FCC that the cost increase of a set-top decoder with the increased bandwidth required by Option 5 is likely to be between $5-10. This is unrealistically low since we believe there is at present no solution to the technical difficulties that a LMDS system operating under an Option 5 frequency plan would face.

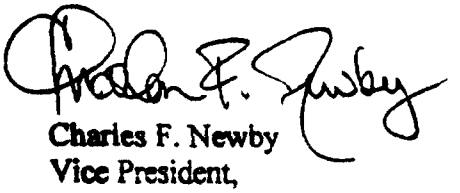
Moreover, the band segmentation dictated by Option 5 would seriously degrade the performance of the new set-top decoder's downconverter, L-band tuner and FM demodulator due to mechanisms that are not under the control of the LMDS operator making the subjective quality of LMDS television service unpredictable. Even mechanisms to deal with the new technical difficulties brought on by Option 5 that are within the operator's control will result in additional complexity and expense that is sure

to make LMDS non-competitive with other multichannel program providers.

The uncertainties associated with the band segmentation plan dictated by Option 5, if it is adopted, would so severely impair the level and quality of the services that could be offered by an LMDS operator that it is doubtful that LMDS as currently envisioned would survive.

For these reasons, Titan urges you to do everything that you can do to see that the FCC rejects Option 5. As the provider of the set-top decoders for CellarVision's LMDS system, and a company that has committed millions of dollars to the development of equipment for the emerging LMDS industry, Titan considers this to be a matter of grave concern.

Sincerely,



Charles F. Newby
Vice President,
Titan Information Systems Corporation

— mmTechnic. —
20 Meridian Road
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VIA FAX

Mar. 12, 1996

Mr. Shant Hovnanian, CEO
CT&T
505 Park Ave. 21st Floor
New York, NY 10022

Dear Shant:

I have reviewed the two proposed band segmentation plans, labeled 4 Prime (4') and Plan 5 and have the following comments regarding the effect on the transmitters we provide for the Cellular Vision LMDS systems.

The most striking problem I see with Plan 5 is the 150 MHz band for 29.1 to 29.25 GHz which is restricted to Hub to Sub use only. This band is far enough above the lower LMDS band that I believe it could not effectively be covered by the same block conversion transmitter and transmitter antenna system. The likely result would be a significant cell size reduction due to loss and pattern problems across 1.75 Ghz. The alternative would most likely be a dual transmitter/antenna scheme, which will result in considerable increases in hub transmitter equipment costs.

The other problem I see with plan 5 is the use of the 28.45 to 28.60 GHz band for downstream block conversion video delivery. I anticipate that it could be very difficult to comply with the out of band spurious emissions requirements, under option 5 due to its structure, as it could be very difficult to filter without significant spectrum loss in guard bands. This potentially could limit the band's use to upstream traffic, which would penalize a system that sought to provide video distribution only, as low cost competition to Cable Television.

The 4' plan would appear to eliminate or at least alleviate these problems. The 29.24 GHz band could now be used for upstream traffic. I would estimate a transceiver able to cover this band and the primary downstream band would be more difficult and expensive than if this band were at a lower frequency, closer to the downstream band, but I am quite sure it could be implemented. Plan 4' eliminates the 28.45 to 28.6 GHz band problem of Plan 5 by making that 150 MHz segment contiguous with the lower 700 MHz. This certainly simplifies the filtering, whatever rules are finally adopted regarding spurious emissions.

I think there is no question LMDS could be implemented more cost effectively and provide the consumer with better service under the 4' Plan. Under plan 5, the extra transmitter costs would cause significant competitive disadvantages.

Sincerely yours,

Charles S. Brand
President

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